

REMARKS/ARGUMENTS

1. Applicants acknowledge with appreciation the courtesy of a telephonic interview on July 11, 2006 between Examiner Angela Martin, Supervisory Tracey Dove, and Applicants' Attorney Jeffrey Klayman to discuss the Office action of May 1, 2006.

The Examiners pointed out that the anodes of prior art fuel cells are made of materials that are similar to those disclosed in the subject patent application, e.g., YSZ and nickel oxide. Mr. Klayman pointed out that, while the materials may be similar, the disclosed processes and the resulting fuel cells are quite different than the prior art fuel cells, particular by virtue of building a solid oxide fuel cell starting with the anode such that the anode supports the fuel cell and the electrolyte and cathode layers can be applied as thin layers that simply could not support the fuel cell and do not add any substantive mechanical support to the fuel cell. The Examiners asked for clarification of the meaning of "anode supported," and there was general agreement that the criteria defined by claim 38, i.e., that the thickness of the anode be greater than the 50% of the combined thickness of the anode, electrolyte, and cathode, should be sufficient to distinguish over the prior art references, which show thin anode layers.

Examiner Dove cited US 6551735 (Badding) as showing an anode-supported fuel cell. Mr. Klayman agreed to consider the reference in preparing the response. The Applicants have cited Badding in the accompanying Supplemental Information Disclosure Statement.

2. The Examiner rejected claim 32 under 35 U.S.C. 112, first paragraph. The Examiner also rejected claims 32, 35, and 54 under 35 U.S.C. 102(b) as being anticipated by Kendall; rejected claims 1-13, 16, 29-31, 87, and 91 under 102(b) or

103(a) as being anticipated by Kendall; rejected claims 32, 38, 39, and 54 under 35 U.S.C. 103(a) as being anticipated by Muthuswamy and Ruka '700; rejected claims 32, 40-43, 48-52, and 54 under 35 U.S.C. 103(a) as being anticipated by Kendall and Ruka '713; and rejected claims 29, 32, 36-38, 53, 54, and 88-90 under 35 U.S.C. 103(a) as being anticipated by Kendall and Stover. The Examiner indicated that claims 36, 37, 44-47, and 88-90 contain allowable subject matter, but it appears that claims 36, 37, and 88-90 in fact stand rejected as being anticipated by Kendall and Stover.

3. Applicants respectfully restate their position, presented on the record in earlier filed responses, that the presently claimed invention is allowable over Kendall, Ruka '700, Ruka '713, and Stover. The references disclose cathode and electrolyte supported SOFCs. While these references disclose SOFC materials that are similar to those employed in embodiments of the present invention, the processes disclosed in the subject patent application and the resulting anode-supported SOFCs are substantially different. Thus, neither Kendall, Ruka '700, Ruka '713, nor Stover, alone or in combination, teaches or otherwise suggests an anode-supported tubular solid oxide fuel cell as claimed.

That being said, Applicants respectfully direct the Examiner's attention to U.S. Patent No. 6,436,565 (Song), which has been cited by the Applicants in the accompanying Supplemental Information Disclosure Statement. Song is directed to a fuel electrode-supported tubular solid oxide fuel cell (i.e., an anode supported SOFC) that uses materials and processes similar to those employed in exemplary embodiments of the present invention. In this respect, Applicants respectfully submit that Song is arguably the most relevant piece of art to date.

As in certain embodiments disclosed in the subject patent application, Song's anode is formed from a mixture containing stabilized zirconia and nickel oxide. Unlike embodiments disclosed in the subject patent application, however,

Song also includes a distinct pore forming agent (e.g., carbon powder) in the anode mixture (see, for example, column 3, lines 14-16). Song combusts the pore forming agent during a subsequent sintering process in order to form pores in the anode. Song recognizes that incomplete combustion of the pore forming agent affects the efficiency of the anode (see column 6, lines 43-54).

In embodiments of the present invention, pores are formed by reduction of the nickel oxide or other electrochemically active substance in the anode without the use of a distinct pore forming substance. As discussed in the application beginning at page 13, line 22, no pore-forming substance is added to create the pores in the anode tube. Addition of a pore-forming substance creates the risk of changing the size of the tube when the pores form, and of creating cracks in the electrolyte layer. Thus, an embodiment according to the invention avoids the need to add a pore-forming substance. This embodiment involves first creating a fully dense, sintered system (which may be made, for example, in accordance with the process of the embodiment of Fig. 3, or the manufacturing process "Example"); and then reducing the nickel oxide (or other oxide of an electrochemically active substance) that is present in the anode, to form nickel (or other reduced form of an electrochemically active substance). The reduction may be performed, for example, by passing a reducing gas (such as hydrogen) through the cell, at the operating temperature of approximately 800 to 1000°C, after sintering the cell in air.

Applicants note that, while Badding discloses an anode-supported SOFC fuel cell having a porous anode (albeit one that is arguably not "tubular" in the context of the subject patent application and Song), Badding is silent as to the manner in which the pores are formed, other than saying that the anode is formed from an anodic material such as porous metallic nickel (see column 2, lines 63-64).

Claim 32 has been amended to require a tubular anode having pores formed by reduction of an oxide of an electrochemically active substance without inclusion of a distinct pore forming substance, and also to incorporate the criteria of claim 38 that the thickness of the anode comprise over 50% of a total thickness of the anode, the electrolyte, and the cathode. Thus, amended claim 32 is directed to an anode-supported SOFC having a porous anode formed without the use of a pore forming substance. Claim 38 has been canceled due to incorporation of its subject matter into claim 32. Claims 55-86 have also been canceled as being directed to non-elected subject matter.

For the reasons stated above, Applicants respectfully submit that independent claim 32 and its dependents are allowable over the cited references, including Kendall, Ruka '700, Ruka '713, Stover, Song and Badding.

4. All pending claims are believed to be in a form suitable for allowance. Therefore, the application is believed to be in a condition for allowance. The Applicant respectfully requests early allowance of the application. The Applicant requests that the Examiner contact the undersigned, Jeffrey T. Klayman, if it will assist further examination of this application.

5. Applicants petition for a one month extension of time. In the event that a further extension is needed, this conditional petition of extension is hereby submitted, and Applicants request that deposit account number 19-4972 be charged for any fees that may be required for the timely consideration of this application.

Respectfully submitted,



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